RESULTS GROUP

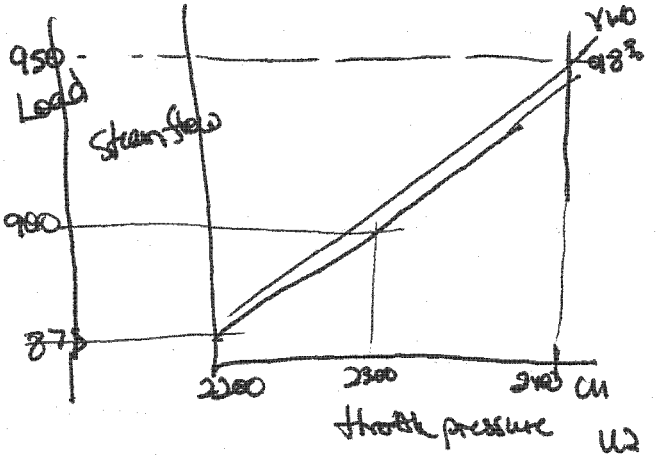
w/ HP Turb Upgrade
Operating Conditions

Need) New Allstrom Heat Balance Diagrams

@ ____ MW 2400psi YWO ____6.6 million #/hr
@ ____ MW 2400 psi 98%+ normal valve position

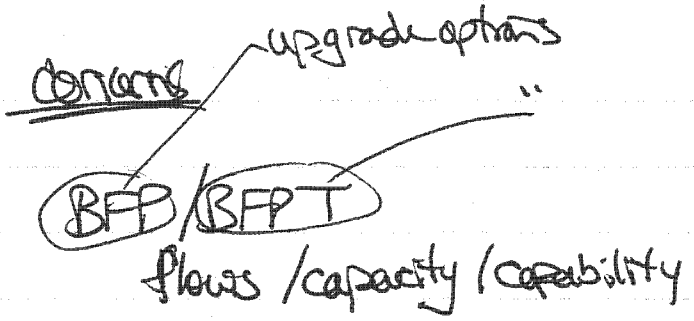
NOTE: sliding press mode of operation NOT VALVE CONTROL
Load Reduction → Steam pressure

Curve



calc new Heat Rate w/ new HP turbine

875 – 895 Helper Enabled
900 – 920
925 – 945


Concerns
upgrade options
"
BFP/BFPT
flows / capacity / capability

1 IP Turbine

GE

4th stage

Extraction (enlarging orifice)

HP outlet temp/press

Allstrom

3rd stage extraction

loss 23 mW today (2mW HP)

gain 1.2% NCTHR

16.2 incr extraction flow

ffw 554.1 Δ20

ffw 574.1 increase

(Allstrom alternative measurement

Wheel power

9 HP

Testing @ reduced press can't get max capacity

HP turbine - Replacement

1/3/01

① Options:
~~[illegible]~~ @ 875 ↓ flow ↑ perf

② ↑ flow

890 throttling losses

③

925

15 m/year loss ??

SGC - not increase steam flow ???
need to have access / redundancy

GE - schedule issues | install 2 MoStm
2 Reheat

extr

Unit 2 1/13/01

HP TURBINE RETROFIT Bid Award Evaluation		
Item	GEII	Alstom
Requested Unit 2 2002 Outage Start Date	March 29, 2002 One month setback	No Change Requested
Guaranteed Delivery Date for Unit 2 HP	April 1, 2002	March 1, 2002
Guaranteed HP Section Efficiency	92.1%	92.4%
Guaranteed Section Wheel Power Output	293.480 MW	293.6 MW
Unit 1 HP Section - Base Bid	$4,100,141	$4,000,000
Unit 2 HP Section - Base Bid	$4,100,141	$5,050,000
Field Engineering Services - Unit 1	$539,676	Included in base bid
Field Engineering Services - Unit 2	$501,751	Included in base bid
Alignment Services - Unit 1	$40,100	$45,000
Alignment Services - Unit 2	$38,500	$45,000
Freight - Unit 1	$25,000	Included in base bid
Freight - Unit 2	$25,000	Included in base bid
IPSC Cost for Unit 1 HP Disasssembly in 2001	0	$100,000
HP Performance - Bid Evaluation Credit	($14,800)	($40,000)
HP Output - Bid Evaluation Credit	($50,000)	($80,000)
OEM Labor - Unit 1 (Not Included in **Total Cost**)	1,337,993	$1,260,000
OEM Labor - Unit 2 (Not Included in **Total Cost**)	1,269,154	$1,210,000
Total Cost Unit 1 and Unit 2	Price for 42.3 day outage schedule (IPSC Labor) $9,305,509	Price for 30 day outage schedule (IPSC Labor) $9,120,000
	Price for 32 day outage schedule (OEM Labor) $11,977,456	Price for 30 day outage schedule (OEM Labor) $11,590,000

problem meeting schedule - Control-partial assembly shipped

turb generator BOP

300 limit - (problem IP) dropped to 292

1st

Including snout (downside)

Includes - Stop valves, control valves + IP turb overhaul

Award by mid-Jan

IP7010629

HP TURBINE UPGRADE PROJECT

Outstanding Issues

As we prepare to take advantage of the increased efficiency and output afforded by the HP Turbine upgrade there are several systems that require evaluation and possible modification. The most significant items identified to-date that require detailed assessment and potential upgrade within the foreseeable future are shown below with a first approximation cost estimate:

Future (not on budget)

Item	Estimate/Unit
Cooling Tower Performance Upgrade 2002-3	$4,000,000
• Main Steam Safety Valve Addition (2)	$ 150,000
• Cold Reheat Safety Valve Addition (2)	$ 150,000
• Generator Cooling Enhancement	$ 100,000
• Generator Isophase Cooling Enhancement	$ 50,000
• Large Motor Bus Loading Equalization	$ 150,000
• ID Fan Intake Duct Design	$ 100,000
• Boiler Feed Pump Performance Upgrade	$ 150,000
• Main Step-up Transformer - current estimate (OEM conceptual comments due 1/12/01)	$ 100,000

Structural

(Full load testing on PA and FD fans is recommended for establishing current baseline.)

As part of the HP turbine upgrade project, each of the items listed above will be analyzed in detail with specific regard to:

- Maximum Continuous O ility
- Burners additional redesign
- U1 - replaced
- U2 - needs upgraded design
- CT performance

Thes ecember and will continue through mid 2001.
Func ncluded in the upcoming 2001-02 budget.

Circ Water Makeup
increase supply flow

In th uired modifications, load and flow could be
main st two conventional methods: throttling or sliding pressure. Throttling
throtl bine efficiency losses associated with
increa of reduced load would be in the range of 1%
of Tur nually. Throttle pressure reduction
associ ld be in the range of 0.75% of Turbine Heat
Rate o gest economic penalty would come from
potenti ear of 10 MW additional output is worth
approx

PULV - pyrite pulling capacity

PULV - motors

BFPT? increase perf?

ID fan motors

FD fan motors

- Evaluations GE/CE, B&W, others

Additional Items already identified

HP TURBINE UPGRADE PROJECT

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As part of the HP turbine upgrade project, each of the items listed above will be analyzed in detail with specific regard to:

- Maximum Continuous Operating Capability
- Operating Efficiency
- Operating Redundancy
- Maintenance Impacts
- System and Unit Reliability
- Required Capital Improvements
- Economic Justification

These analyses have been underway since early December and will continue through mid 2001. Funds for these modifications have not yet been included in the upcoming 2001-02 budget.

In the event that staff chooses to minimize the required modifications, load and flow could be maintained at or near current levels through at least two conventional methods: increasing throttling losses or reducing throttle pressure. Turbine efficiency losses associated with increased throttling for the six (6) summer months of reduced load would be in the range of 1% of Turbine Heat Rate or approximately $410,000 annually. Throttle pressure reduction associated with a load reduction of 10 percent would be in the range of 0.75% of Turbine Heat Rate or approximately $310,000 annually. The largest economic penalty would come from potential lost revenue. Using present factors, one year of 10 MW additional output is worth approximately $4,170,000.

NUHR

From: James Nelson
To: Aaron Nissen; Blaine Ipson; Conf 4; Dale Hurd; Dennis Killian; Gale Chapman; George Cross; James Nelson; Jerry Hintze; Joe Hamblin; Jon Finlinson; Kelly Cloward; Mike Alley; Neil Clay; Norman Mincer; Phong Do; Rand Crafts; Richard Houston
Date: 1/3/01
Time: 3:00PM - 4:00PM
Subject: Balance of Plant Issues - HP Turbine Upgade
Place: Conf 4

Issues for discussion:
1. Position on NSR and action plan
2. Balance of Plant - system analyses
3. Budgeting for analyses and modifications

Upgrade of the U2 HP Turbine in Spring 2002 brings a number of analysis and modification issues to the surface. Budgeting and timing aspects require clarification from staff.

HP TURBINE UPGRADE PROJECT

Outstanding Issues

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REHEAT Superheater Safety Valve Capacities

SERVICE	VALVE NO.	CAPACITY lbs/hr		SET PRESSURE	CAP. AT SATURATION	DESIGN TEMP.	SUPERHEAT FACTOR
Cold Reheat	1SGJ-RV-1	472,297		681	517,302	630	0.913
Cold Reheat	1SGJ-RV-2	472,297		681	517,302	630	0.913
Cold Reheat	1SGJ-RV-3	479,769		692	525,487	630	0.913
Cold Reheat	1SGJ-RV-4	479,769		692	525,487	630	0.913
Cold Reheat	1SGJ-RV-5	485,204		700	531,439	630	0.913
Cold Reheat	1SGJ-RV-6	485,204		700	531,439	630	0.913
Cold Reheat	1SGJ-RV-7	488,600		705	535,159	630	0.913
Cold Reheat	1SGJ-RV-8	488,600		705	535,159	630	0.913
Cold Reheat Total		3,851,740					
Hot Reheat	1SGJ-RV-9	361,435		630	479,357	1005	0.754
Hot Reheat	1SGJ-RV-10	361,435		630	479,357	1005	0.754
Hot Reheat	1SGJ-RV-11	367,045		640	486,797	1005	0.754
Hot Reheat	1SGJ-RV-12	367,045		640	486,797	1005	0.754
Hot Reheat Total		1,456,960	27.44%				
Total Reheat Relieving Capacity		5,308,700					

Current (assuming both FW Htrs I/s)

MStm 6.90

RH 5.57

@ least 15% relieving capacity in Hot reheat

@ least 15% relieving capacity in Hot Steam

IP7010634

REHEAT Superheater Safety Valve Capacities

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Cold Reheat	1SGJ-RV-1	472,297		681	517,302	630	0.913
Cold Reheat	1SGJ-RV-2	472,297		681	517,302	630	0.913
Cold Reheat	1SGJ-RV-3	479,769		692	525,487	630	0.913
Cold Reheat	1SGJ-RV-4	479,769		692	525,487	630	0.913
Cold Reheat	1SGJ-RV-5	485,204		700	531,439	630	0.913
Cold Reheat	1SGJ-RV-6	485,204		700	531,439	630	0.913
Cold Reheat	1SGJ-RV-7	488,600		705	535,159	630	0.913
Cold Reheat	1SGJ-RV-8	488,600		705	535,159	630	0.913
	NEW	488,600					
Cold Reheat Total		4,340,340					
Hot Reheat	1SGJ-RV-9	361,435		630	479,357	1005	0.754
Hot Reheat	1SGJ-RV-10	361,435		630	479,357	1005	0.754
Hot Reheat	1SGJ-RV-11	367,045		640	486,797	1005	0.754
Hot Reheat	1SGJ-RV-12	367,045		640	486,797	1005	0.754
Hot Reheat Total		1,456,960	25.13%				
Total Reheat Relieving Capacity		5,797,300					

Assuming a Reheater Steam Flow of 5,775,000 lbs/hr:
One (1) additional valve on the cold reheat will do!

Economic Analysis
2001-2002 Proposed Capital Project

High Pressure Turbine
Dense Pack Modification

Approximately two years ago, Alstom came to Intermountain and presented information on a proposed renovation of the high pressure turbines. GE has subsequently also contacted us regarding the same modification.

The proposed modification involves changing the existing double-flow hp nozzle box to a single flow design. By doing this they are able to add stages to the hp turbine and increase hp section efficiency. Both Alstom and GE claim to have data from installed units showing an increase in turbine efficiency (decrease in flow to achieve the same output) of at least 2.0%.

The modification will be a turnkey performance contract including pre- and post-installation testing on the hp turbine section for contract validation. The following economic analysis is provided for both performance benefits and increased generation capacity.

Economic assumptions:

1- Economic life:	20 years (PV of Annuity Factor 11.2)
2- Hours of operation/year:	8340 (8760 - 2.5 weeks ave.outage)
3- Cost of money:	6.35%
4- Cost of generation:	$42,000/ unit hour ($48.00/MW hr)
5- Avoided cost of maintenance during 2002 outage:	$708,000
6- Avoided cost of lost generation to rehab the hp nozzle:	$1,944,000 (3 days of estimated 10 required)

Additional Generation Capacity at Existing Steam Flow:

Additional potential revenue
(2.0%)(875MW)($48.00/MW hr)(8340 hrs/yr) = $7,005,600

Payback: $3,348,000 (6,000,000 - items 5&6) / $7,005,600 = 0.48 years

Cost/ Benefit Ratio: (7,005,600)(11.2)/(3,348,000) = 23.4

Heat Rate Improvement at 875MW:

Fuel Savings
(2.0%)(6.3MMlb/hr steam flow)(916 BTU/lb)(1/.88 boiler eff.)(875/830)($1.51/MMBTU) (8760hrs/yr)(0.9cap factor)
= $1,646,027/yr

Payback: $3,348,000 / $1,646,026 = 2.0 years

Cost/Benefit Ratio: ($1,646,027 X 11.2)/(3,348,000) = 5.5